General

Guideline Title

Safe handling of cytotoxics.

Bibliographic Source(s)

Easty A, Coakley N, Cheng R, Cividino M, Savage P, Tozer R, White R, Safe Handling of Cytotoxics Expert Panel. Safe handling of cytotoxics. Toronto (ON): Cancer Care Ontario (CCO); 2013 Dec 16. 75 p. (Evidence-based series; no. 16-3). [61 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Green E, Johnston M, Macartney G, Milliken D, Poirier S, Reynolds P, et al. Safe handling of parenteral cytotoxics. Toronto (ON): Cancer Care Ontario; 2007 Apr 13.

The EVIDENCE-BASED SERIES report, initially the full original Guideline, over time will expand to contain new information emerging from their reviewing and updating activities.

Please visit the Cancer Care Ontario Web site for details on any new evidence that has emerged and implications to the guidelines.

Recommendations

Major Recommendations

In the recommendations that follow, the following action verbs are used to help the intended user determine the level of variation one might expect from following that recommendation. These are:

Legislation/regulation requires – A recommendation that is supported by law, regulation or standard. All centres and users would be expected to implement this recommendation with little variation.

Strongly recommend – A recommended course of action or practice based on evidence in the medical literature and/or a strong consensus of the expert panel. Variation from this course of action or practice should be based on a considered judgment of how the local circumstances may vary from those typically found in practice.

Recommend – A course of action or practice which, in the consensus of the expert panel, is sound and worth considering, but whose implementation may vary according to local circumstances.

Recommendation 1: General Measures

Committee Responsible for Policy and Procedures for Cytotoxic Drugs

It is strongly recommended that all institutions administering cytotoxic drugs form such a committee. It is also strongly recommended that this committee include, but not be limited to, representatives from various departments and services such as: occupational health and safety, joint health and safety committee, pharmacy, nursing, medical oncology (physician), environmental services and risk management.

This committee would be responsible for clear processes of developing, reviewing and revising policies and procedures related to cytotoxic drugs. In addition, this committee is responsible to ensure that there is a process in place for orientation and ongoing education for the identified target population.

This committee is responsible for implementation and follow-up of the Risk Prevention Management Program related to the use of cytotoxic drugs.

Continuing Education and Orientation Program

It is legislated that initial and ongoing hospital-approved education be provided to all staff involved with cytotoxic drugs throughout the medication circuit including safe handling and spill or leak management (Ontario Ministry of Labour, 2013). It is strongly recommended that all staff have initial and ongoing training to best practice standards in place at the time.

It is legislated that there is documentation that annual training of safe handling of cytotoxic drugs has occurred (Ontario Ministry of Labour, 2013).

Identification and Safety

It is strongly recommended that each institution maintain a list of cytotoxic drugs.

It is legislated that cytotoxic drugs and their waste be properly identified with the symbol capital "C" and, under it, the words "CYTOTOXIC/CYTOTOXIQUE" in capital letters (Canadian Standards Association [CSA], 2009; Ontario Ministry of the Environment, 2013). It is legislated that all cytotoxic waste under the Ministry of Environment regulation (guideline C4) include bilingual wording and both the words and the symbol appear on a dark grey rectangle (CSA, 2009; Ontario Ministry of the Environment, 2013).

Purchasing of Drugs

When purchasing cytotoxic drugs, it is strongly recommended that institutions consider vendors that include safe handling measures such as pre-wiped or protective containers, or smaller receptacles to decrease volume of potential spills.

Spills Kit

It is strongly recommended that a spill-management kit be available in all areas where cytotoxic drugs are stored, transported, handled and administered.

Precautionary Reassignment

It is strongly recommended that all staff be fully informed of the potential reproductive hazards of cytotoxic drugs (BC Cancer Agency, 2012).

It is strongly recommended that the facility consider alternative duties for women who are pregnant or breast feeding.

Recommendation 2: Personal Protective Equipment (PPE)

It is legislated that a worker work in compliance with the Occupational Health and Safety Act and regulations and use or wear the equipment, protective devices or clothing that the employer requires to be used (Ontario Ministry of Labour, 1990).

It is legislated that the appropriate personal protective equipment for the task (as described in Table 1 in the original guideline document) be worn throughout the medication circuit (Ontario Ministry of Labour, 1990). It is the employer's responsibility to provide the necessary protective equipment and training on how to use the equipment.

Gloves

The gloves used to handle cytotoxic drugs are strongly recommended to comply with American Society for Testing and Materials (ASTM) standard D-6978-(05)-13 and be powder free (ASTM International, 2013). Gloves are recommended to be nitrile, polyurethane, neoprene or latex (ASTM International, 2013). Latex is a known allergen, therefore it is strongly recommended that this be taken into consideration for glove selection. It is strongly recommended that vinyl gloves not be used. It is strongly recommended that the frequency of glove changes be adjusted according to the level of exposure at each step in the medication circuit. For example, when administering reconstituted medications, it is strongly recommended that workers change gloves immediately if torn, punctured, or visibly contaminated with a cytotoxic drug, and to ensure following

Routine Practices (Public Health Ontario, 2012). It is strongly recommended that great care be taken in the removal of gloves to not contaminate the skin. When two pairs of gloves are required, put on the first pair before putting on the gown. See Appendix F in the original guideline document for the donning and doffing of one pair of gloves and Appendix G in the original guideline document for the donning and doffing of two pairs of gloves.

Gown

It is strongly recommended that the gowns used for handling cytotoxic drugs be disposable, made of lint-free, low-permeability fabric, have long sleeves with tight-fitting cuffs and fasten in the back. Gowns need to be changed in the event of contamination, spillage, rips, and at the end of the procedure.

For medication preparation, gowns need to be changed halfway through a shift or every 3.5 hours (ASTM International, 2012). It is strongly recommended that the supplier be able to certify that the gown protects against cytotoxic drugs.

It is strongly recommended that care be taken to avoid contamination of the hands by avoiding touching the outside of the gown when removing the gown.

Facial Protection

Surgical/procedure masks are required while handling and preparing medications in a biological safety cabinet and, in this instance, are worn to prevent microbial contamination of the sterile field.

It is strongly recommended that full-facial protection be worn whenever there is a risk of splashing (e.g., during certain drug administration procedures). The use of a full-facial shield is preferred. If goggles are used, they need to be worn in conjunction with a fluid-resistant mask. For further information, see CSA standard Z94.3-07 – Eye and Face Protectors (CSA, "Eye," 2007).

Respiratory Protection Apparatus (RPA)

It is strongly recommended that fit-tested respirators such as NIOSH certified N95 or N100 be used when there is a risk that airborne powder or aerosol will be generated. It is legislated that respirators be used in accordance with a respiratory protection program such as that outlined in CSA Standard Z94.4-11 "Selection, Use and Care of Respirators" (Ontario Ministry of Labour, 1990; Accreditation Canada, 2014).

Cap

Caps are only required in the sterile preparation room and are worn to prevent microbial contamination of the sterile field.

Shoe Covers

Disposable shoe covers are worn to prevent contamination of the health care workers' shoes, and it is strongly recommended that they be worn when in the sterile preparation room or in the event of a spill. It is strongly recommended that shoe covers be removed immediately when leaving the sterile prep room to avoid contamination of other areas.

See Table 1 in the original guideline document for information on personal protective equipment to be worn throughout the medication circuit.

Recommendation 3: Receiving and Transport

Handling Cytotoxic Drug Delivery Containers

It is strongly recommended that all receiving-dock workers receive training in the proper handling of cytotoxic drugs. It is strongly recommended that the receiving-dock workers check the integrity of the external packaging upon receipt; in the event of breakage or a damaged parcel likely to cause a spill, apply the Spill Protocol from your institution.

It is strongly recommended that delivery containers be taken immediately to the Pharmacy Department by the receiving-dock workers or the distributor.

It is strongly recommended that the receiving-dock or storeroom workers not open the delivery containers. It is strongly recommended that the delivery containers be handled with care to avoid breakage of the cytotoxic drug containers and not be left unattended in a corridor. Only trained workers (e.g., pharmacy technicians) are to proceed with the unpacking and subsequent steps.

Damaged Containers/Spill

It is strongly recommended that damaged containers be handled like spills. It is strongly recommended that the manufacturer or distributor be

notified if the container is received in a damaged state. To limit exposure, it is strongly recommended that a damaged container never be returned to the manufacturer or distributor. Notify the pharmacy if any damaged containers are suspected.

Recommendation 4: Unpacking and Storage

Packaging can have high levels of contamination. It is strongly recommended that there be an unpacking area in the pharmacy limiting exposure risks. It is strongly recommended that the unpacking area be a separate dedicated space, separate from eating areas, preferably a separate room. It is regulated that there be adequate ventilation in the area, negative pressure and preferably vented to the outside (Accreditation Canada, 2014). It is strongly recommended that there be a receptacle for cytotoxic waste in the unpacking area, for the disposal of secondary packaging (Ontario Ministry of Labour, 2013; CSA, 2010).

It is strongly recommended that workers at risk of exposure wear a protective gown and two (Ontario Ministry of Labour, 1990) pairs of gloves when unpacking and cleaning cytotoxic drugs, from the opening of the external packaging to the placing of the secondary and/or primary packaging in their storage space. It is strongly recommended that workers check the integrity of all packaging at every step of the unpacking process. In the event of breakage or leaking, it is strongly recommended that the damaged contents be treated as a spill. It is strongly recommended that the primary and or secondary packaging be cleaned prior to being placed in storage.

It is strongly recommended that a regular cleaning protocol be in place either at this stage or prior to storage in the clean room. It is strongly recommended that all drug containers be cleaned to reduce external contamination. An example is the use of pre-moistened towelettes. It is important to ensure that the procedure does not damage the container or interfere with the reading of the label. It is also important to ensure than any product that is used will not further contaminate. However, it is strongly recommended that this procedure not increase the risk of incidents/accidents due to damage to the cytotoxic drug container or label.

It is strongly recommended that procedures be in place to minimize the risk of contamination of surfaces during the cleaning of vials (e.g., use of a disposable, plastic-backed, absorbent pad). It is strongly recommended that all surfaces be cleaned when the task is complete.

Establish a dedicated negative-pressure storage area for cytotoxic drugs that minimizes the risk of contamination (Accreditation Canada, 2013).

When removing or transporting drugs out of the storage area, it is strongly recommended that one pair of gloves and a gown be worn.

Recommendation 5: Cytotoxic Drug Preparation

Planning the Oncology Pharmacy

It is strongly recommended that the oncology pharmacy be in compliance with relevant guidelines from the Canadian Society of Hospital Pharmacists (CSHP) and Accreditation Canada standards. While the specific details of oncology pharmacy planning is beyond the scope of this document, details and some important considerations may be found in the Canadian Standard Association document CSA Z8000-11 (CSA, 2011).

It is strongly recommended that special requirements for heating, ventilation and air-conditioning (HVAC) systems in health care facilities be taken into consideration (CSA, 2010).

A class II type B biological safety cabinet is required with preference for the type B2, because it ensures that there is no recirculation of air within the cabinet (Health Canada, 2004).

There is emerging evidence suggesting some robotic devices that prepare cytotoxics improve the accuracy of medication preparation and reduce potentially harmful staff safety events. Further studies are required to establish the cost effectiveness of these robotic implementations. Each health care facility will need to assess the need for such devices in their environment (Seger et al., 2012).

It is strongly recommended that all mixing, and preparation of administration sets with a cytotoxic drug be performed in one centralized area in a specially designated class II type B biological safety cabinet that (CSA, 2010):

a. Is exhausted through a high-efficiency particulate absorption (HEPA) filter to the outside atmosphere in a manner that prevents recirculation into any inside area
b. Has exhaust and ventilation systems that remain in operation for a sufficient period of time to ensure that no contaminants escape from the biological safety cabinet into the workplace
c. Is equipped with a continuous monitoring device to permit confirmation of adequate airflow and cabinet performance

It is recommended that airlocks be considered if there are particular concerns about the propagation of airborne cytotoxic drugs.

It is strongly recommended that priming of administration sets be prepared in the manner mentioned above.

It is strongly recommended that the layout allow and facilitate the unimpeded cleaning of all surfaces (walls, floors, ceilings, doors, diffusers, windows). It is strongly recommended that the furniture and equipment in the sterile preparation room be kept to a bare minimum. It is strongly recommended that there be a visual link, for example, a window and a way to communicate between the sterile preparation room and the pharmacy, in order to view the work in progress. It is strongly recommended that access to the sterile room be limited to trained and authorized workers.

Limit worker traffic, particularly near unpacking and storage areas (to avoid accidental breakage) and near preparation cabinets (to avoid interfering with their proper operation).

It is legislated that the facilities include an emergency eyewash that may or may not be hooked up to the airlock sink (Ontario Ministry of Labour, 1990). As a minimum, it is strongly recommended that emergency eyewash be able to provide 15 minutes of flushing to both eyes (American National Standard Institute [ANSI], 2009). It is strongly recommended that a full shower be accessible nearby (e.g., in the oncology units/clinics).

Closed-drug transfer systems (e.g., PhaSeal®) are not a substitute for class II type B biological safety cabinets. There is evidence from studies (Favier et al., 2012; Nyman, Jorgenson, & Slawson, 2007; Sessink et al., 2011; Siderov, Kirsa, & McLauchlan, 2010; Yoshida et al., 2011; Yoshida et al., 2009) that closed-drug transfer-systems can reduce contamination during preparation. Further emerging evidence suggests that when these devices are not used as specified, they could become open to the environment. Further research is needed to evaluate this possibility.

It is strongly recommended that the biological safety cabinets remain in operation 24 hours a day, 7 days a week, as recommended by the manufacturers.

In the non-sterile drug preparation process (e.g., oral preparations), it is strongly recommended that the same level of worker protection be adhered to.

Pharmacy Policies and Procedures

Establish policies and procedures regarding preventive maintenance, monitoring, certification and the optimal use of facilities and equipment (ANSI, 2008).

Recommendation 6: Drug Preparation

The following recommendations apply to the preparation of all cytotoxic medications including parenteral, oral and topical, both sterile and non-sterile preparations. It is strongly recommended that policies and procedures include the use of appropriate personal protective equipment, the equipment for preparation including appropriate ventilation, and other automated equipment for packaging and a dedicated work area.

Personal Protective Equipment

It is strongly recommended that workers (pharmacists or pharmacy technicians) wear a cap, surgical/procedure mask, shoe covers, a protective gown and two (Ontario Ministry of Labour, 1990) pairs of gloves (see Table 1 in the original guideline document) to make sterile preparations of cytotoxic drugs in preparation cabinets.

Organization of the Work

Organize the work to limit microbial and environmental contamination.

For both sterile and non-sterile preparations, it is strongly recommended that workers cover the work surface with a disposable, absorbent, sterile, plastic-backed pad to absorb any liquid contamination that may occur during handling. It is strongly recommended that the pad not cover the front and rear grilles of the preparation cabinet. It is strongly recommended that it be changed after 3.5 hours of continuous work or for a new batch of preparations (e.g., a set of vials of a given drug) or in the event of a spill or contamination. It is legislated that the pad be disposed of in a cytotoxic waste receptacle (Ontario Ministry of the Environment, 2013).

Limit the quantity of supplies and cytotoxic drugs in the cabinet, to avoid adversely affecting the laminar flow and to facilitate regular cleaning of the work surface; place the sterile products in the centre and the non-sterile products (e.g., waste receptacle) along the sides of the cabinet.

Removal of Packaging

Remove the packaging, when applicable, and clean all of the drug containers before taking them into the preparation cabinet. For sterile preparations, adhere to aseptic technique for sterility.

Handling Techniques

Use handling techniques that limit the risk of injury or accidental exposure.

It is strongly recommended that spiking of bags and priming of tubing occur before the addition of the cytotoxic drug unless the clinical protocol requires otherwise.

Preparation, Priming and Removing Air from the Tubing

It is strongly recommended that cytotoxic drugs be reconstituted in the pharmacy environment as described above. It is strongly recommended that the drug containers not be overfilled to avoid compromising the integrity of the container. It is strongly recommended that the techniques used for priming and removal of air minimize the exposure risks. It is strongly recommended that air never be removed from the intravenous (IV) tubing with a solution containing the drug. It is strongly recommended that IV tubing is primed and air removed in the pharmacy, prior to adding the cytotoxic drug(s) to the infusion solution. Glass containers are not recommended due to increased risk of breakage and exposure.

Labeling and Final Packaging

It is legislated that cytotoxic drugs be labeled to inform those handling these preparations of the nature of the drugs and the precautions to be taken. It is legislated that cytotoxic drugs display the "Cytotoxic" hazard symbol or the word "Cytotoxic" (CSA, 2009; Ontario Ministry of the Environment, 2013).

It is strongly recommended that the outside surface of the cytotoxic drug containers (e.g., syringes, infusion bags, tubing) in the preparation cabinet be cleaned in the cabinet.

Place each cytotoxic drug container (e.g., syringe, bag), as well as the administration supplies (e.g., tubing), in a clear, leak-proof plastic bag (e.g., Ziploc® type) to facilitate identification by the nurse without having to remove the container from the bag.

Following final verification, it is strongly recommended that the plastic bags containing the cytotoxic drugs be placed in a rigid transport container (ideally opaque), properly identified with the "Cytotoxic" hazard symbol.

Waste

It is strongly recommended that everything that comes out of the cabinet be wiped clean.

It is strongly recommended that all contaminated waste be disposed of in the chemotherapy waste stream.

Recommendation 7: Transport and Storage following Preparation

On-site Transport of Cytotoxic Drugs

Transport cytotoxic drugs using a method that will prevent contamination of the environment in the event of breakage.

It is strongly recommended that cytotoxic drugs be placed in a closed, leak-proof plastic bag (e.g., Ziploc® type).

It is strongly recommended that transport of the cytotoxic drug in a closed, leak-proof plastic bag from the pharmacy to an area not adjacent to the preparation area (e.g., care unit, outpatient clinic), be done in a rigid, shock-resistant, leak-proof container made of a material that can be easily cleaned and decontaminated in the event of a drug leak. It is strongly recommended that the bottom be covered with an absorbent, plastic-backed cloth. It is legislated that the transport container be identified with the "Cytotoxic" hazard symbol and be cleaned regularly (CSA, 2009; Ontario Ministry of the Environment, 2013).

It is strongly recommended that mechanical transport systems, such as pneumatic tubes, not be used because of the stress they put on the contents, and the whole transport system would be compromised if a leak occurred.

It is strongly recommended that prepared medications be stored in a designated area prior to administration. It is strongly recommended that this area be cleaned regularly.

Off-site Shipping and Transport of Cytotoxic Drugs

Establish policies and procedures regarding the shipping of cytotoxic drugs (Transport Canada, 2013).

In the event that cytotoxic drugs are shipped off-site (e.g., from one institution to another), it is strongly recommended that they be packed separately from other drugs, according to the recommendations from the manufacturer and distributor. It is strongly recommended that pharmacy be consulted in the packaging of cytotoxic drugs.

It is strongly recommended that cytotoxic drugs be packed in a double plastic bag and placed in a box that is properly identified with the "Cytotoxic" hazard symbol. If necessary, immobilize the drug with packing material (International Society of Oncology Pharmacy Practitioners [ISOPP] Standards of Practice, 2007). It is legislated that the "Cytotoxic" hazard symbol be visible on the outside of the delivery container (ISOPP Standards of Practice, 2007). It is strongly recommended that reusable delivery containers be cleaned regularly.

Ensure that the courier company will handle cytotoxic drugs.

Recommendation 8: Drug Administration

It is strongly recommended that safe handling and administration techniques be used to minimize possible exposure to individuals and the environment when administering cytotoxic drugs.

- It is legislated that appropriate personal protective equipment be made available to all healthcare workers and be worn as prescribed by the employer, please refer to Table 1 in the original guideline document (Ontario Ministry of Labour, 1990).
- It is strongly recommended that Luer-Lock connectors and needleless administration systems be used to administer any intravenous medications.
- Closed systems may offer additional protection.
- It is strongly recommended that disposable plastic-backed absorbent pads be used over work surfaces and placed under tubing or bag connections and ports when attaching any tubing, bag or syringe that have been exposed to a cytotoxic drug.
- Unless a closed system is used, never disconnect tubing from cytotoxic drug bags. Discard bag with attached tubing into an appropriate waste container as a single unit.
- It is legislated that safety engineered needles be used as per Needle Safety Regulation 474/07 made under the Occupation Health and Safety Act Labour, 2010 (Ontario Ministry of Labour, 2010). Do not purge air from the needle before administration.
- It is strongly recommended that oral cytotoxics be handled in a manner that avoids skin contact, liberation of aerosols or powdered medicine into the air, and cross-contamination with other medicines (Roos & Makela, 1997).
- It is strongly recommended that solid oral preparations (tablets) of cytotoxic drugs be crushed or cut within the biological safety cabinet. If patients are unable to take in the solid format, it is strongly recommended that the pharmacy provide these drugs in an oral syringe, in a ready-to-administer, liquid oral form.
- It is strongly recommended that application of topical cytotoxic drugs be done using appropriate personal protective equipment and in a way that prevents contamination of the environment. Between applications, it is strongly recommended that the cytotoxic medication (i.e., tube or jar) be kept in a safe container (i.e., Ziploc) and in a secure place that prevents contamination of the surrounding environment.
- With any intravesical administration, e.g., bladder instillation, ensure there are detailed procedures in place to avoid risks of splashing.
- Use caution when administering intrathecal cytotoxic drugs, as there is risk of splashing due to increased intrathecal pressures.

Recommendation 9: Home Care

Home Care of Patients who Have Received Cytotoxic Drugs

It is strongly recommended that all cytotoxic drugs preparations be compounded in pharmacies meeting the requirements for cytotoxic drug preparation.

It is strongly recommended that cytotoxic drugs be transported, administered and disposed of by individuals who have received appropriate training. It is strongly recommended that cytotoxic drug transport containers are not reused by patients for domestic purposes, which may expose the family to cytotoxic drugs (e.g., toy box, sewing basket, etc.)

It is legislated that the health care provider who administers cytotoxic drugs in the home wear Personal Protective Equipment as outlined in Table 1 in the original guideline document (Ontario Ministry of Labour, 1990).

It is strongly recommended that health care providers follow the same recommendations outlined in Recommendation 8 - Drug Administration.

It is strongly recommended that a spill kit be readily available in the home in case of accidental spills.

It is strongly recommended that patients be informed of and be provided with written instructions for the safe handling of cytotoxic drugs.

It is strongly recommended that contact information be provided for home care patients who require assistance with safe handling of cytotoxics.

Cytotoxic Drug Waste in the Home

It is strongly recommended that the institution have a clear process to address the issue of cytotoxic waste from patients in their homes, in compliance with municipal or local cytotoxic waste rules. It is strongly recommended that this process include patient and caregiver education.

It is strongly recommended that caregiving staff provide the patients/caregivers involved in administering cytotoxic drugs in the home with a process for appropriate disposal of cytotoxic waste, including left-over drugs.

Recommendation 10: Management of Waste

Bodily-Fluid Waste

It is strongly recommended that workers who handle the biological fluids, excreta, contaminated bedding and soiled equipment of patients who have received cytotoxic drugs wear one (Association paritaire pour la santé et la sécurité du travail du secteur affaired sociales [ASSTSAS] & Institute de recherche Robert-Sauvé en santé et en sécurité du travail [IRRST], 2008) pair of gloves and a protective gown. It is strongly recommended that face protection be worn when there is a risk of splashing.

Cytotoxic Drug Waste

Establish policies and procedures as per provincial legislation regarding cytotoxic waste management.

The term "cytotoxic waste" includes any material that comes into contact with cytotoxic drugs during their storage, handling, preparation, administration and disposal (e.g., packaging material, protective equipment, preparation supplies, such as syringes, tubing, drug bags), soiled disposable incontinent briefs of patients who have received cytotoxic drugs during the previous 48 hours or longer depending on the drug [e.g., it is known that cyclophosphamide may persist for several days], hood pre-filters and HEPA filters, etc.)

It is legislated that cytotoxic waste be placed in a waste container clearly identified with the "Cytotoxic" hazard symbol. It is legislated that cytotoxic waste be disposed of in the appropriate containers (Ontario Ministry of the Environment, 2013).

It is legislated that sharps be placed in rigid containers with a leakproof lid; CSA standard Z316.6--07 specifies the use of the colour red for the rigid containers (CSA, "Evaluation," 2007). If the containers are another colour, follow the instructions of the company ensuring the final disposal (Ontario Ministry of the Environment, 2013).

It is strongly recommended that other waste (soft items, such as tubing, protective equipment, etc.) be placed in leak-proof and tear-resistant containers, identified with the "Cytotoxic" hazard symbol.

For final disposal outside the institution, it is legislated that all cytotoxic waste be in a rigid, leakproof, container identified with the "Cytotoxic" hazard symbol and scheduled for transport outside the institution (Ontario Ministry of the Environment, 2013).

It is legislated that any excess fluid from cytotoxic drugs (e.g., drug loss) be disposed of in a sealed container and placed in a rigid container, the bottom of which is to be covered with an absorbent pad. This rigid container will be handled like other cytotoxic waste (Ontario Ministry of the Environment, 2013).

It is recommended that disposable/incontinent briefs soiled by patients who have received cytotoxic drugs be placed in a cytotoxic waste container.

It is legislated that cytotoxic waste be incinerated at a high temperature (i.e., 800°C to 1200°C, depending on the product) (Ontario Ministry of the Environment, 2013).

It is legislated that cytotoxic waste not be disposed of in the receptacles used for infectious biomedical waste (which may be autoclaved and then sent to a landfill site) (Ontario Ministry of the Environment, 2013).

It is legislated that every area where cytotoxic drugs are handled will have an appropriate cytotoxic waste receptacle as close as possible to the work area (Ontario Ministry of the Environment, 2013).

The lids of cytotoxic drug receptacles must remain closed, except when depositing waste. Bins with foot pedals and lids, which lock automatically when full, are recommended to minimize exposure.

It is strongly recommended that workers be careful to avoid contaminating the outside of the receptacle when depositing waste.

It is legislated that the transport of cytotoxic waste receptacles be assigned to properly trained workers (Ontario Ministry of Labour, 1990).

It is strongly recommended that workers who handle cytotoxic waste receptacles wear one pair of disposable gloves and have a spill kit at their disposal. It is strongly recommended that the waste go through as few care units, public areas and areas containing food or linens as possible.

It is legislated that the final storage areas for cytotoxic waste receptacles be secure. Refer to Ontario storage requirements (CSA, 2009; Ontario Ministry of the Environment, 2013).

Recommendation 11: Accidental Exposure

Be aware of any mandatory reporting requirements under the Occupational Health and Safety ACT and report requirements to Workplace Safety and Insurance Board (WSIB) (Ontario Ministry of Labour, 1990).

Establish policies and procedures regarding accidental worker exposure.

If a cytotoxic drug accidentally comes into contact with a worker's skin or clothing, it is strongly recommended that the worker immediately remove the contaminated clothing and thoroughly wash the skin of the affected area with soap and water and continue to rinse for 15 minutes. If appropriate, it is strongly recommended that the contaminated worker take a shower. It is strongly recommended that a deluge shower be made available in the vicinity (e.g., in the oncology clinics/units). It is strongly recommended that all contaminated clothing be discarded in cytotoxic waste.

If a cytotoxic drug comes into contact with a worker's eyes, it is strongly recommended that the worker flush their eyes at an eye wash station. Alternatively, it is recommended that the workers use an isotonic solution to flush their eyes (e.g., sterile NaCl 0.9%). It is strongly recommended that eyes be flushed for at least 15 minutes (ANSI, 2009). It is strongly recommended that if contact lenses are worn, they be removed immediately prior to flushing.

In the event of a needlestick or sharps injury, let the wound bleed freely. Under running water, gently and thoroughly wash the area with soap. Contact Occupational Health. Ensure that facility policies for needlestick or sharps injury are followed including completion of an incident report and reporting to WSIB if indicated.

Recommendation 12: Spills Management

It is strongly recommended that the facility develop policies and procedures for spills management that take into account the types of spills (i.e., amount, location, concentration, powder vs. liquid, etc.)

It is strongly recommended that a spill management kit be readily available within the work area.

It is legislated that items from the clean-up of spills be placed in the cytotoxic waste receptacle (Ontario Ministry of the Environment, 2013).

Most spills can be contained and managed by the trained health care worker (e.g., leaking IV tubing).

When a spill is not contained or easily managed (e.g., exposure to large volume of fluid that is a risk to the environment or a large crate of vials filled with powder broken in the receiving area), it is strongly recommended that a Code Brown or equivalent be called.

Recommendation 13: Environmental Cleaning

Establish environmental cleaning policies and procedures for all surfaces where contact with cytotoxic drugs may occur. Examples may include: unpacking and storage, preparation, administration and disposal areas. Pharmacy counters are among the most contaminated surfaces.

It is strongly recommended that cleaning of the biological safety cabinets be performed by trained personnel following manufacturers guidelines (Canadian Association of Pharmacy in Oncology [CAPhO], 2009).

Use of Pumps to Administer Cytotoxic Drugs

Make sure there is an appropriate policy to clean and inspect the equipment between uses.

Laundry

Ensure the facility complies with the Occupational Health and Safety Act - Ontario Regulation for Health Care and Residential Facilities (Ontario Ministry of Labour, 2013).

Recommendation 14: Medical Surveillance and Environmental Monitoring

Medical Surveillance

Methods used to investigate potential health effects of exposure to cytotoxic drugs are inconclusive and difficult to interpret. The ideal test should meet several requirements — it should be sensitive, specific, quantitative, rapid, and reproducible. Importantly, the procedures for taking a sample should be non-invasive and should not cause unnecessary duress or anxiety to the individual. Unfortunately, there is currently no suitable test to meet these requirements. As a consequence, there is conflicting information and opinion about the value of routine biological monitoring for employees handling cytotoxic drugs.

Employers do have a responsibility to ensure that they remain aware of and apply any future developments for monitoring the health of employees in the handling of cytotoxic drugs.

The panel supports further research to determine if there are adverse health effects that result from exposure to cytotoxic drugs.

Adherence to agreed standard operating procedures with sufficient initial and regular on-going training in safe handling/administration is paramount to reducing potential for exposure and risk.

There is evidence in the literature of a higher rate of spontaneous abortion among women working in roles that expose them to cytotoxic drugs (Lawson et al., 2012; Quansah & Jaakkola, 2010). There are no other identified medical conditions known to result from chronic exposure of health care workers to cytotoxic drugs, no exposure limits set for cytotoxic drugs, and no standards for interpretation of test results of exposed health care workers to enable meaningful interpretation or action based on biological monitoring results.

Environmental Monitoring

It is recommended that the facility consider implementing an environmental monitoring program. Surface testing would audit contamination of the environment (e.g., pharmacy counters, patient bedside tables) and provide a quality indicator of cleaning effectiveness and adherence to recommended work practices.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Any condition requiring cytotoxic drug therapy

Guideline Category

Prevention

Clinical Specialty

Oncology

Pharmacology

Intended Users

Advanced Practice Nurses

Allied Health Personnel

Health Care Providers

Hospitals

Nurses

Pharmacists

Physician Assistants

Physicians

Guideline Objective(s)

To update and address new issues in cytotoxic handling that have developed since the previous guideline, including the use of oral cytotoxics, selection and use of personal protective equipment, and treatment in diverse settings including in the home setting

Target Population

Health care workers who may come into contact with cytotoxic drugs at any point in the medication circuit. The medication circuit includes all steps through which the drug travels, from the receiving dock to the storage facility, as well as its preparation, administration and disposal. Exposure is possible throughout the medication circuit in the hospital or in the home setting.

Interventions and Practices Considered

1. Formation of a committee responsible for policy and procedures for cytotoxic drugs
2. Provision of continuing education and orientation program for all staff involved with cytotoxic drugs
3. Maintenance of a list of cytotoxic drugs by all institutions
4. Consideration of vendors by institutions that include safe handling measures
5. Personal protective equipment (gown, gloves, facial protection, respiratory protection apparatus, cap, shoe covers)
6. Receiving and transport of cytotoxic drugs
7. Unpacking and storage of cytotoxic drugs
8. Cytotoxic drug preparation
    - Oncology pharmacy planning, policies and procedures
    - Personal protective equipment for pharmacists/pharmacy technicians
    - Work organization
    - Packaging removal
    - Handling techniques
    - Preparation, priming and removing air from the tubing
    - Labeling and final packaging
    - Disposal of waste
9. Transport and storage of cytotoxic drugs following preparation
    - On-site transport
    - Off-site transport and shipping
10. Drug administration techniques and safe handling
    - Home care management of patients receiving cytotoxic drugs
    - Cytotoxic drug waste disposal in the home
11. Management of waste
    - Body fluid waste disposal
    - Cytotoxic drug waste disposal
12. Management of accidental worker exposure to cytotoxic drugs
13. Management of spills
14. Environmental cleaning procedures (cleaning of pumps, laundry)
15. Medical surveillance of employees
16. Environmental monitoring program

Major Outcomes Considered

- Closed-transfer systems
- Pregnancy-related outcomes
- General health outcomes

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Search for Existing Systematic Reviews

Systematic reviews for the safe handling of cytotoxics were searched for using MEDLINE, EMBASE and the Cochrane Database of Systematic reviews (2006 to September 2011).

Identified systematic reviews that required further consideration based on the criteria above would be assessed using the AMSTAR tool. The results of the AMSTAR assessment would be used to determine whether or not an existing review could be incorporated as part of the evidentiary base.

Any identified reviews that did not meet the criteria above, whose AMSTAR assessment indicated important deficiencies in quality, or that were otherwise not incorporated as part of the evidence base would be reported in the reference list, but not further described or discussed.

Primary Literature Systematic Review

Assuming that no existing systematic reviews were identified, or that identified guidelines were incomplete in some fashion, a systematic review of the primary literature was also planned. This review would be reduced in scope, such as a reduction in subject areas covered, time frames covered, etc., based on the scope of incorporated existing reviews. The criteria described below are written assuming no existing reviews would be incorporated.

Literature Search Strategy

As the 2006 Ontario Guideline had already addressed the three topic areas, the new search was limited to articles published from 2007 onward. The MEDLINE (2007 to November 2012), EMBASE (2007 to December 2013), and Cochrane Library (2013, Issue 3) databases were searched for technology assessments, systematic reviews, clinical trials and studies investigating the safe handling of cytotoxics. Reference lists of papers and review articles were scanned for additional citations. Search terms indicative of cytotoxic drugs were used. The full search strategy is available in Appendix A in the original guideline document.

Study Selection Criteria and Protocol

Inclusion Criteria

1. Technology assessments, systematic reviews, clinical trials and studies investigating the safe handling of cytotoxics.

Exclusion Criteria

1. Review articles
2. Letters and editorials that reported clinical trial outcomes

One author did a review of the titles and abstracts that resulted from the search. For those items that warranted full-text review, one author reviewed each item in collaboration with the working group.

Guideline Review

Almost all PEBC document projects begin with a search for existing guidelines that may be suitable for adaptation. Adaptation includes a wide spectrum of potential activities from the simple endorsement, with little or no change, of an existing guideline, to the use of the evidence base of an existing guideline with *de novo* recommendations development.

Guidelines from 2007 to 2012 were searched for using the following databases.

- Inventory of Cancer Guidelines (SAGE) – http://www.cancerguidelines.ca/Guidelines/inventory/index.php
- National Guideline Clearinghouse – http://www.guideline.gov/
- Canadian Medical Association Journal (CMAJ) InfoBase – http://www.cma.ca/index.php/ci_id/54316/la_id/1.htm
- National Institute for Health and Care Excellence (NICE) (UK) – http://www.nice.org.uk/guidance/index.jsp
- Scottish Intercollegiate Guidelines Network (SIGN) (UK) – http://www.sign.ac.uk/guidelines/index.html
- American Society of Clinical Oncology (ASCO) (US) – http://www.asco.org/quality-guidelines
- National Comprehensive Cancer Network (NCCN) (US) – http://www.nccn.org/ (consensus-based)
- National Health and Medical Research Council (Aus) – http://www.nhmrc.gov.au/publications/subjects/cancer.htm
- New Zealand Guidelines Group - http://www.nzgg.org.nz/index.cfm?fuseaction=fuseaction_10&fusesubaction=docs&documentid=22#Cancer

In addition, the websites of several, known, high-quality guideline developers were searched:

- National Institute of Occupational Safety and Health (NIOSH) – http://www.cdc.gov/niosh/
- International Society of Oncology Pharmacy Practitioners (ISOPP) – http://www.isopp.org/
- American Society of Health-System Pharmacists (ASHP) – www.ashp.org/
- Health and Safety Executive (HSE) – www.hse.gov.uk/
- Occupational Safety and Health Administration (OSHA) – www.osha.gov/

In addition, the MEDLINE (2007 to September 2011) and EMBASE (2007 to November 2011) databases were searched for guidelines. Only guidelines published after 2007 were considered. Twenty-nine guidelines were identified for current review. Of those, 20 were given to the working group for further consultation. Only five of those guidelines were found to be relevant and underwent a further review by the working group.

Number of Source Documents

- Literature search for closed-system transfer: 16 articles met the inclusion criteria.
- Literature search on pregnancy outcomes: 2 articles were included.
- Literature search on general health outcomes: 1 article was included in the review.
- Guideline review: 5 guidelines were included in the review.

Methods Used to Assess the Quality and Strength of the Evidence

Expert Consensus

Rating Scheme for the Strength of the Evidence

Not applicable

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Data Extraction and Assessment of Study Quality and Potential for Bias

Data extraction was done independently by one author. An audit of the extracted data was conducted by staff at the Program in Evidence-based Care (PEBC). Ratios, including hazard ratios (HRs), were expressed with a ratio <1.0 indicating that subjects exposed to the intervention experienced a lower probability of an event compared to the control. All extracted data and information were audited by an independent auditor.

Important quality features, such as potential bias by study sponsor, for each study were extracted.

Synthesizing the Evidence

When clinically homogenous results from two or more trials were available, a meta-analysis would be conducted using the Review Manager software (RevMan 5.1) provided by the Cochrane Collaboration. For time-to-event outcomes, HRs, rather than the number of events at a certain time point, would be the preferred statistic for meta-analysis, and would be used as reported. If the HR and/or its standard error were not reported, they would be derived from other information reported in the study, if possible, using the methods described by Parmar et al. For all outcomes, the generic inverse variance model with random effects, or other appropriate random effects models in RevMan would be used.

Statistical heterogeneity would be calculated using the χ^2 test for heterogeneity and the I^2 percentage. A probability level for the χ^2 statistic less than or equal to 10% ($p \leq 0.10$) and/or an I^2 greater than 50% would be considered indicative of statistical heterogeneity.

Guideline Review

Guidelines that were considered relevant to the objectives and the research questions were evaluated by the working group for quality using the Appraisal of Guidelines Research and Evaluation (AGREE II) instrument. Details of the scores can be found in Appendix C in the original guideline document.

Each guideline was assessed using the following categories that were formulated by the working group: policies and procedures, personal protective equipment (PPE), ventilated cabinets, closed systems, syringes and IV sets, transport and labeling, education and training, pregnancy, surveillance, medical surveillance, spills, homecare, nursing administration and handling of waste. Details of those results can be found in Appendix D in the original guideline document.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

Formation of Guideline Development/Working Group

The Systemic Treatment and Nursing clinical programs asked the Program in Evidence-based Care (PEBC) to update the guideline on cytotoxic handling. In consultation with the systemic treatment and nursing groups, a Working Group was identified. This Working Group has representation from a research scientist and a human factors specialist, a pharmacist, an occupational health physician, a nurse, a medical oncologist and a methodologist. The Working Group and Systemic Treatment and Nursing clinical programs also formed the Cytotoxic Handling Guideline Development Group (GDG). This group would take responsibility for providing feedback on the guideline as it was being developed and acted as the Expert Panel for the document at Internal Review, reviewing the document and requiring changes as necessary before approving it.

Guideline Review

The working group went through each one of the "Prevention Guide: Safe Handling of Hazardous Drugs" (see the "Adaptation" field) recommendations in detail and checked off the following boxes: Endorse, Endorse with reservation, Needs further consideration, Recommendations not supported in Ontario context, and Abstain. Since the results of this exercise varied between individuals and were not unanimous, it was decided that the working group would go through each recommendation as a group. The working group in consultation with the guideline sponsor realized that many of these recommendations were far too prescriptive for the purpose of this Ontario Guideline update. Recommendations were then agreed upon and reduced to high-level statements.

The working group met 10 times from March 2012 to April 2013 to work on the recommendations. The recommendations still have the same group structure as the original "Prevention Guide: Safe Handling of Hazardous Drugs" guideline, but the wording has been changed. Some recommendations were deleted, because they were not applicable to Ontario, and others were collapsed into a single recommendation. In instances where the group needed more information than was provided, a search of the primary literature was done. This was done in three instances and is described in Section 2 in the original guideline document. The working group relied on the expertise of a member of the expert

panel when there were specific questions about the handling of cytotoxic waste in Ontario that could not be answered by the working group. While this guideline was adapted, recommendations that are backed by law, regulation or standard are footnoted and written using the term "legislation requires." All users would be expected to implement this recommendation with little variation.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

Expert Panel Review and Approval

The Cytotoxic Handling Expert Panel acted as the Expert Panel for this document. The document must be approved by formal vote. In order to be approved, 75% of the Cytotoxic Handling Expert Panel membership must cast a vote or abstain, and of those that vote, 75% must approve the document. At the time of the voting, Cytotoxic Handling Expert Panel members could suggest changes to the document, and possibly make their approval conditional on those changes. In those cases, the Working Group was responsible for considering the changes, and if those changes could be made without substantially altering the recommendations, the altered draft would not need to be resubmitted for approval again.

The Cytotoxic Handling Expert Panel reviewed the document through May and June 2013, which was sent to members of the panel through email.

Report Approval Panel Review and Approval

The purpose of the Report Approval Panel (RAP) review is to ensure the methodological rigour and quality of Program in Evidence-based Care (PEBC) documents. The RAP consists of nine clinicians with broad experience in clinical research and guideline development, and the Director of the PEBC. For each document, three RAP members review the document: the Director and two others. RAP members must not have had any involvement in the development of the guideline prior to Internal Review. All three RAP members must approve the document, although they may do so conditionally. If there is a conditional approval, the Working Group is responsible for ensuring the necessary changes are made, with the Assistant Director of Quality and Methods, PEBC, making a final determination that the RAP's concerns have been addressed. Due to the nature of this report, only the Director of the PEBC reviewed this document. This document was adapted from another guideline and, therefore, had very little methodological matters that needed reviewing.

In July 2013 the Director of the PEBC reviewed this document. The Director approved the document on July 23, 2013.

External Review by Ontario Clinicians and Other Experts

The PEBC external review process is two-pronged and includes a targeted peer review that is intended to obtain direct feedback on the draft report from a small number of specified content experts and a professional consultation that is intended to facilitate dissemination of the final guidance report to Ontario practitioners.

Following approval of the document at Internal Review, the Cytotoxic Handling Working Group circulated the draft document with recommendations modified as noted under Internal Review, above, to external review participants for review and feedback. Appendix E in the original guideline document summarizes the draft recommendations and supporting evidence developed by the Cytotoxic Handling Expert Panel as submitted for External Review.

Methods

Targeted Peer Review

During the guideline development process, three targeted peer reviewers from Ontario and British Columbia considered to be clinical and/or methodological experts on the topic were identified by the working group. Several weeks prior to completion of the draft report, the nominees were contacted by email and asked to serve as reviewers. Three reviewers agreed and the draft report and a questionnaire were sent via email for their review. The questionnaire consisted of items evaluating the methods, results, and interpretive summary used to inform the draft recommendations and whether the draft recommendations should be approved as a guideline. Written comments were invited. The questionnaire and draft document were sent out on September 19, 2013. Follow-up reminders were sent at 2 weeks (email) and at 4 weeks (telephone call). The Cytotoxic Handling Working Group reviewed the results of the survey.

Professional Consultation

Feedback was obtained through a brief online survey of health care professionals who are the intended users of the guideline. The survey was sent to all oncology nurses who administer systemic treatment, pharmacy workers, environmental service managers, occupational health professionals, and medical oncologists in the PEBC database were contacted by email to inform them of the survey. The survey was sent to 167 people: 159 from Ontario, 4 from British Columbia, 1 from Manitoba, 1 from Nova Scotia, 1 from Prince Edward Island and 1 from Newfoundland. Participants were asked to rate the overall quality of the guideline (Section 1) and whether they would use and/or recommend it. Written comments were invited. Participants were contacted by email and directed to the survey website where they were provided with access to the survey, the guideline recommendations (Section 1) and the evidentiary base (Section 2). The notification email was sent on September 20, 2013. The consultation period ended on November 1, 2013. The Cytotoxic Handling Working Group reviewed the results of the survey.

Conclusion

This Evidence-based Series (EBS) report reflects the integration of feedback obtained through the external review process with final approval given by the Cytotoxic Handling Expert Panel and the Report Approval Panel of the PEBC. Updates of the report will be conducted in accordance with the PEBC Document Assessment and Review Protocol.

Evidence Supporting the Recommendations

References Supporting the Recommendations

Accreditation Canada. Medication management standards: for surverys starting after: January 01, 2014; Version 8. 2013.

American National Standard Institute (ANSI). Standard for emergency eyewashes and shower equipment. Z358.1. 2009.

American National Standard Institute. Biosafety cabinetry: Design, construction, performance, and field certification. NSF/ANSI 49. 2008.

Association paritaire pour la santÃ© et la sÃ©curitÃ© du travail du secteur affaired sociales (ASSTSAS), Institute de recherche Robert-SauvÃ© en santÃ© et en sÃ©curitÃ© du travail (IRRST). Prevention guide; safe handling of hazardous drugs. [internet]. MontrÃ©al (QuÃ©bec): 2008 [accessed 2013 Jul 31].

ASTM International. Assessment of resistance of medical gloves to permeation by chemotherapy drugs. D-6978-05. 2013.

ASTM International. Standard test method for permeation of liquids and gases through protective clothing materials under conditions of continuous contact. F739-12. 2012.

BC Cancer Agency. Employee health: management of risks related to cytotoxic agents; V-20. [internet]. Vancouver (BC): 2012 [accessed 2013 May 06].

Canadian Association of Pharmacy in Oncology (CAPhO). Standards of practice for oncology pharmacy in Canada. Version 2. 2009.

Canadian Standards Association (CSA). Canadian Health Care Facilities. Z8000-11. 2011.

Canadian Standards Association (CSA). Evaluation of single use medical sharps containers for biohazardous and cytotoxic waste second edition. CSA Z316.6-07. 2007.

Canadian Standards Association (CSA). Eye and face protectors. Z94.3-07. 2007.

Canadian Standards Association (CSA). Handling of waste materials in health care facilities and veterinary health care facilities. CSA Z317.10-09. 2009. 60 p.

Canadian Standards Association (CSA). Special requirements for heating, ventilation, and air-conditioning (HVAC) systems in health care facilities. CAN/CSA-Z317.2-10. 2010.

Favier B, Labrosse H, GillesAfchain L, Cropet C, Perol D, Chaumard N, Latour JF, Hild P. The PhaSealÂ® system: impact of its use on workplace contamination and duration of chemotherapy preparation. J Oncol Pharm Pract. 2012 Mar;18(1):37-45. PubMed

Health Canada, Health Canada. The laboratory biosafety guidelines, 3rd edition. 2004.

ISOPP Standards of Practice: Section 2 - Transport of cytotoxics. J Oncol Pharm Pract. 2007;13(Suppl 3):7-9.

Lawson CC, Rocheleau CM, Whelan EA, Lividoti Hibert EN, Grajewski B, Spiegelman D, RichEdwards JW. Occupational exposures among nurses and risk of spontaneous abortion. Am J Obstet Gynecol. 2012 Apr;206(4):327.e1-8. PubMed

Nyman HA, Jorgenson JA, Slawson MH. Workplace contamination with antineoplastic agents in a new cancer hospital using a closed-system drug transfer device. Hosp Pharm. 2007;42(3):219-25.

Ontario Ministry of Labour. Occupational Health and Safety Act - Health care and residential facilities. Ontario Regulation 67/93. [internet]. Toronto (ON): 2013 [accessed 2013 Jul 31].

Ontario Ministry of Labour. Occupational Health and Safety Act - Needle safety. 474/07. [internet]. Toronto (ON): 2010 [accessed 2013 Jul 30].

Ontario Ministry of Labour. Occupational Health and Safety Act R.S.O. 1990, c. O.1 2011. [internet]. Toronto (ON): 1990 [accessed 2013 Jul 31].

Ontario Ministry of the Environment. Guideline C-4: the management of biomedical waste in Ontario. [internet]. Toronto (ON): [accessed 2013 Jul 30].

Public Health Ontario. Provincal Infectious Diseases Advisory Committee (PIDAC). Routine practices and additional precautions. 2012 Nov.

Quansah R, Jaakkola JJ. Occupational exposures and adverse pregnancy outcomes among nurses: a systematic review and meta-analysis. J Womens Health (Larchmt). 2010 Oct;19(10):1851-62. PubMed

Roos I, Makela T. Human resource issues in cytotoxic drug dispensing. J Oncol Pharm Pract. 1997;3(4):200-18.

Seger AC, Churchill WW, Keohane CA, Belisle CD, Wong ST, Sylvester KW, Chesnick MA, Burdick E, Wien MF, Cotugno MC, Bates

DW, Rothschild JM. Impact of robotic antineoplastic preparation on safety, workflow, and costs. J Oncol Pract. 2012 Nov;8(6):344-9. PubMed

Sessink PJ, Connor TH, Jorgenson JA, Tyler TG. Reduction in surface contamination with antineoplastic drugs in 22 hospital pharmacies in the US following implementation of a closed-system drug transfer device. J Oncol Pharm Pract. 2011 Mar;17(1):39-48. PubMed

Siderov J, Kirsa S, McLauchlan R. Reducing workplace cytotoxic surface contamination using a closed-system drug transfer device. J Oncol Pharm Pract. 2010 Mar;16(1):19-25. PubMed

Transport Canada. Transport of dangerous goods. [internet]. Ottawa (ON): [accessed 2013 Apr 05].

Yoshida J, Koda S, Nishida S, Yoshida T, Miyajima K, Kumagai S. Association between occupational exposure levels of antineoplastic drugs and work environment in five hospitals in Japan. J Oncol Pharm Pract. 2011 Mar;17(1):29-38. PubMed

Yoshida J, Tei G, Mochizuki C, Masu Y, Koda S, Kumagai S. Use of a closed system device to reduce occupational contamination and exposure to antineoplastic drugs in the hospital work environment. Ann Occup Hyg. 2009 Mar;53(2):153-60. PubMed

Type of Evidence Supporting the Recommendations

The type of evidence supporting the recommendations is not specifically stated.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Safe handling of cytotoxic drugs

Potential Harms

Not stated

Qualifying Statements

Qualifying Statements

Care has been taken in the preparation of the information contained in this report. Nonetheless, any person seeking to apply or consult the report is expected to use independent medical judgment in the context of individual clinical circumstances or seek out the supervision of a qualified clinician. Cancer Care Ontario makes no representation or guarantees of any kind whatsoever regarding the report content or use or application and disclaims any responsibility for its application or use in any way.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Quick Reference Guides/Physician Guides

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Staying Healthy

IOM Domain

Effectiveness

Safety

Identifying Information and Availability

Bibliographic Source(s)

Easty A, Coakley N, Cheng R, Cividino M, Savage P, Tozer R, White R, Safe Handling of Cytotoxics Expert Panel. Safe handling of cytotoxics. Toronto (ON): Cancer Care Ontario (CCO); 2013 Dec 16. 75 p. (Evidence-based series; no. 16-3). [61 references]

Adaptation

This guideline was developed primarily by adaptation and endorsement of the guideline "Prevention Guide: Safe Handling of Hazardous Drugs," developed by the Association paritaire pour la santé et la sécurité du travail du secteur affaires sociales (ASSTSAS), and the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST).

Date Released

2007 Apr 13 (revised 2013 Dec 16)

Guideline Developer(s)

Program in Evidence-based Care - State/Local Government Agency [Non-U.S.]

Guideline Developer Comment

The Program in Evidence-based Care (PEBC) is a Province of Ontario initiative sponsored by Cancer Care Ontario and the Ontario Ministry of Health and Long-Term Care.

Source(s) of Funding

The Program in Evidence-based Care (PEBC) is a provincial initiative of Cancer Care Ontario supported by the Ontario Ministry of Health and Long-Term Care. All work produced by the PEBC is editorially independent from the Ontario Ministry of Health and Long-Term Care.

Guideline Committee

Safe Handling of Cytotoxics Expert Panel

Composition of Group That Authored the Guideline

Authors: A. Easty, N. Coakley, R. Cheng, M. Cividino, P. Savage, R. Tozer, R. White

Financial Disclosures/Conflicts of Interest

In accordance with the Program in Evidence-based Care (PEBC) Conflict of Interest (COI) Policy, the guideline authors, Cytotoxic Guideline Development Group members, and internal and external reviewers were asked to disclose potential conflicts of interest.

The working group members declared no conflicts of interest except for AE, who is president and owns a medical consulting company. This company is not engaged in any work related to cytotoxic handling.

The guideline development group members and targeted peer reviewers declared no conflicts of interest except for ER, who was a committee member on a Canadian Standards Association (CSA) standard used in this guideline.

The COI declared above did not disqualify any individuals from performing their designated role in the development of this guideline, in accordance with the PEBC COI Policy. To obtain a copy of the policy, please contact the PEBC office by email at ccopgi@mcmaster.ca.

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Green E, Johnston M, Macartney G, Milliken D, Poirier S, Reynolds P, et al. Safe handling of parenteral cytotoxics. Toronto (ON): Cancer Care Ontario; 2007 Apr 13.

The EVIDENCE-BASED SERIES report, initially the full original Guideline, over time will expand to contain new information emerging from their reviewing and updating activities.

Please visit the Cancer Care Ontario Web site for details on any new evidence that has emerged and implications to the guidelines.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the Cancer Care Ontario Web site.

Availability of Companion Documents

The following are available:

- Safe handling of cytotoxics. Summary. Toronto (ON): Cancer Care Ontario (CCO); 2013 Dec 16. 21 p. Electronic copies: Available in Portable Document Format (PDF) from the Cancer Care Ontario Web site.
- Program in Evidence-based Care handbook. Toronto (ON): Cancer Care Ontario (CCO); 2012. 14 p. Electronic copies: Available in PDF from the Cancer Care Ontario Web site.

Patient Resources

None available

NGC Status

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